2nd prep

(1)

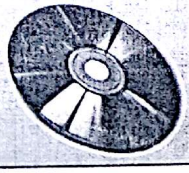
Light waves

- Visible light is one *the waves* present in *the electromagnetic spectrum*.
- Its wavelength ranges between *380 – 700 nanometers.*
- The speed of light is *the distance covered by light in one second.*

First: Analysis of white light

The sun is the main source of light on Earth.

Activity

Steps	*Observation*	*Conclusion*
If you put a compact disc (CD) on a table, you observe the formation of seven colours . 	This is due to the analysis of white light into seven colours.	The white light consists of a mixture of seven colours (spectrum colors) They are Red, Orange, Yellow, Green, Blue, Indigo, Violet.

(2)

Activity

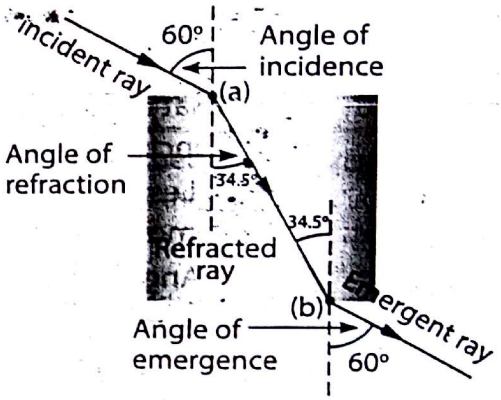
Demonstration of light refraction and some related concepts: 2nd prep.

Materials

- Thick rectangular glass block - pencil - white paper sheet - ruler - protractor - laser pen.

Steps

1. Put the rectangular glass block on the white paper sheet and mark around the block using the pencil.
2. Direct a ray from the laser pen to point of incidence (a) on the periphery of the rectangular prism and draw its path using the pencil and the ruler to represent the incident ray.



3. Draw the path of the emergent ray from the point (b) on the opposite side of the rectangular prism.
4. Remove the rectangular prism and join the two points (a) and (b) with a straight line to represent the refracted ray.
5. Draw at (a) and (b) two vertical lines, each represents the normal at the point of incidence on the boundary surface.

bservations

- The angle between the light ray and the normal in air differs from that in glass. (Angle of incidence ≠ Angle of refraction)
- The light ray changes its path.
- Incident light ray is parallel to emergent light ray.
- Angle of incidence = Angle of emergence.

nclusion

- Changing the path of light when it travels from a transparent medium to another transparent one of different optical density is called light refraction.

2nd prep

Activity *To show the light intensity (brightness)*

③

Experiment	Observation	Conclusion
1)-Stand at 1 meter apart from a wall in a dark room& direct the light of a torch towards it. 2)-Repeat by increasing the distance.	Light intensity decreases as the distance increases.	Light intensity is the amount of light falling perpendicular to a unit area of a surface in one second.

N.B

As the distance between the wall& the light source increases, the quantity of light incident on the unit area of the surface decreases.

The inverse square law:

The light intensity of a surface is inversely proportion to the square of the distance between the surface& the light source.

$$I \propto 1/d^2$$

Intensity — Square distance

Activity (4)

Identification of the laws of light reflection

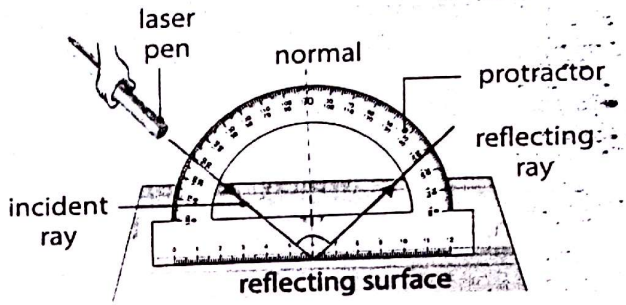
2nd prep.

Materials

- Plane mirror - protractor - laser pen - table.

Steps

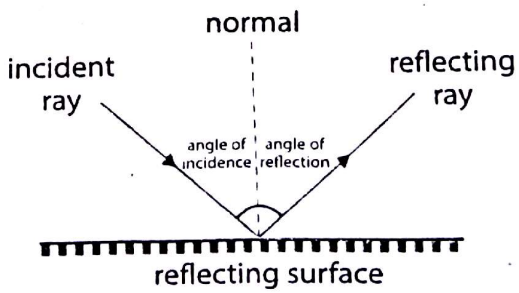
1. Fix a plastic protractor in a vertical position perpendicular to the surface of a plane mirror placed on a surface of a table.
2. Direct a laser beam from the laser pen to pass the protractor surface with an angle of incidence 30° and falls on the mirror at the point of incidence (a).



3. Change the angle of incidence several times and measure the angle of reflection in each time.
4. Change the inclination of the mirror, where the angle between them isn't 90°.

Observations

- The angle of reflection changes according to the change of the angle of incidence, since they are equal.
- The reflected ray isn't seen in step number (4).



Conclusion

- The reflection of light is governed by two laws.

  The first law : The angle of incidence = Tha angle of reflection.

  The second law: The incident light ray, the reflected light ray and the normal to the surface of reflection at the point of incidence, all lie in the same plane perpendicular to the reflecting surface.

2nd prep

(5) **Activity**

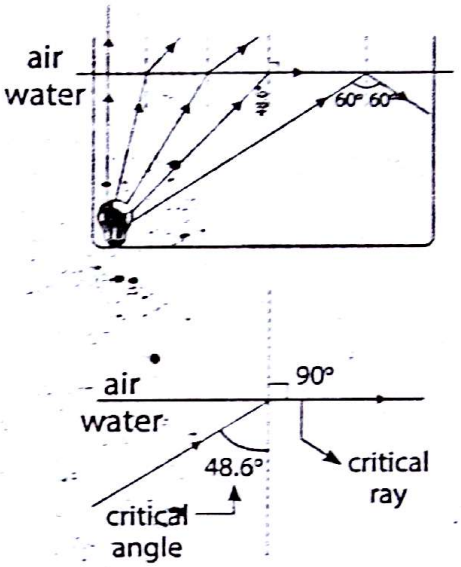
To identify the concepts of the critical angle and total internal reflection.

Materials

- Source of light - trough filled with water.

Steps

1. Fix a source of light at one of the sides of a basin filled with water to be able to control the angle of incidence of the light ray.
2. What do you observe when the angle of incidence of the light ray is?
   - Less than 48.6° - equal to 48.6° - more than 48.6°.
   - Angle of refraction increases by increasing angle of incident till it reflects.



Observations

- The light ray refracts away from the normal. (Angle of incidence < 48.6°)
- The light ray refracts tangent to the separating surface.
  (Angle of incidence = 48.6°)
- The light ray is reflected instead of being refracted. (Angle of incidence > 48.6°)

Conclusions

- When the angle of refraction in the least optical dense medium is 90°, the angle of incidence in the most optical dense medium is called the "critical angle" of this medium.
- When the light ray is incident in more optical dense medium with an angle greater than the critical angle of that medium, it is reflected in the same medium which is known as "total internal reflection".

Observations

1. When light ray travels from high optical density to lower one, it refracts far away from normal line.
2. When light ray travels from high dense medium and refracted ray is tangent to the interface, the angle of refraction = 90°, and angle of incidence is called critical angle.
3. When light ray travels from high dense medium to lower one by angle of incidence more than the critical angle, it is called total internal reflection.

6

2nd prep.

Types of sound waves

- 1 Audible sounds
  - Sonic waves
- 2 Non-audible sounds
  - Ultrasonic waves
  - Infrasonic waves

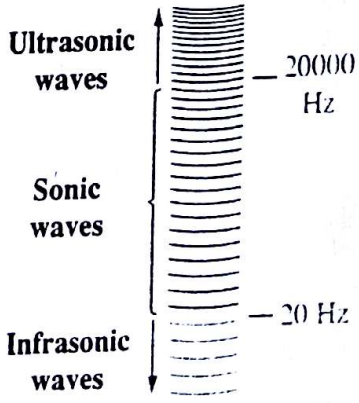
1 Audible sounds

Sonic waves :

They are sound waves of frequencies ranging from 20 to 20000 Hz (20 kHz).

- The human ear transmits the effect of such waves to the brain which translates them into sound and audible tones.

2 Non-audible sounds



(1) Infrasonic waves :

They are sound waves of frequencies less than 20 Hz.

- The human ear cannot hear infrasonic waves.
- These waves accompany the blowing of storms that precede rainfall.

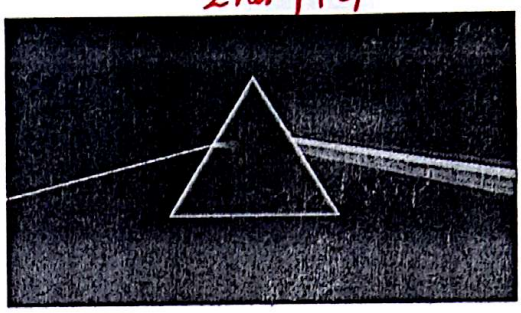
(2) Ultrasonic waves :

They are sound waves of frequencies higher than 20000 Hz (20 kHz).

- The human ears cannot hear ultrasonic waves.
- Some animals such as bats, dogs and dolphins can hear ultrasonic waves.

2nd prep

(7) So When the white light falls on a *triangular prism*, it analysis into *seven spectrum colours.*



Red ⟶ (Lowest deviation, Lowest frequency, Longest wavelength)

Violet ⟶ (Highest deviation, Highest frequency, shortest wavelength)

Max Plank

The German scientist Max Plank proved in 1900 that:

1)-The energy of light waves is composed of energy quanta known as *photons.*

2)-The energy of *photon* is directly proportional to the *frequency*.

3)-Energy of photon = Planck's constant x Photon frequency.

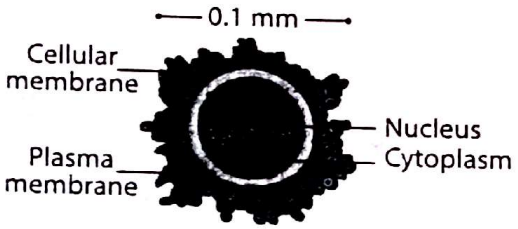
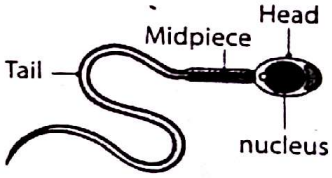
Question Which light has a greater energy the photon of red light or the photon of violet light?

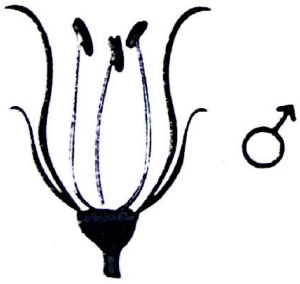
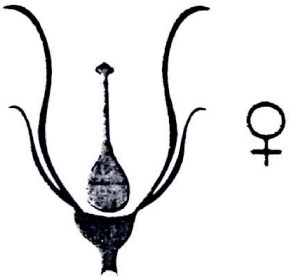
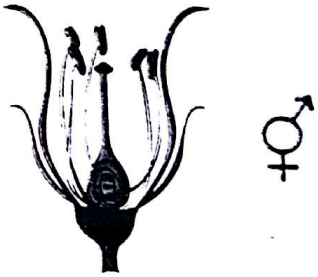
Solution

Since the frequency of red light is less than that of violet light so,
The energy of the photon of red colour is smaller than that of violet light.

Comparison between Ovum and Sperm:

(8) 2nd prep.

	Ovum	Sperm
Size	It is relatively large in size.	It is smaller than ovum
Motion	It is a static spherical cell	It swims to reach the ovum
Composition	1. Nucleus: It contains half of the genetic material for the species. 2. Cytoplasm: It stores food and nutrients. 3. It is coated from outside by an intact cell membrane.	1. Head It contains a nucleus with half of the genetic material. 2. Middle part: It contains mitochondria which is responsible for energy production needed for the movement of the sperm. 3. Tail: It is thin and long and is responsible for swimming and the movement of the sperm to reach the ovum.
Structure	 The structure of the ovum	 The structure of the sperm

Unisexual		Bisexual (hermaphrodite)
Male flower	Female flower	
 ♂	 ♀	 ♂ ♀
• It contains a male reproductive organ (androecium).	• It contains a female reproductive organ (gynoecium).	• It contains male and female reproductive organs (androecium and gynoecium).
Ex: • Palms, Maize and Pumpkins.	Ex: • Palms, Maize and Pumpkins.	Ex: • Tulip, Petunia and Wallflowers.

Some real life applications of ultrasonic waves :

2nd prep

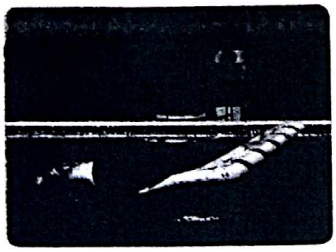
- Ultrasonic waves are used in several medical, industrial and military fields such as :

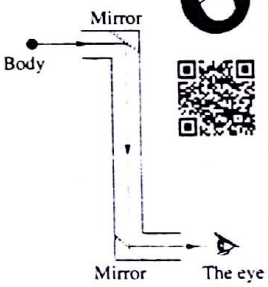
Field	The uses
1. Medical :	1. Breaking down kidney and ureter's stones without any surgical intervention (operations). 2. Diagnosis of male prostate gland tumors and its effect on bladder. 3. Discovering malignant tumors. Sonar
2. Industrial :	Sterilization of food, water and milk as it is characterized by its high ability to kill some types of bacteria and stop the action of some viruses. Milk sterilizer
3. Military :	The discovery of landmines.

Technological applications of light reflection :

The periscope

WWW 16





Periscope
Fig. (A)

Diagrammatic sketch of periscope

- **Scientific basis :**
  Occurrence of regular light reflection in plane mirrors.
- **It is used :**
  1. In submarines to see what is going on the water surface (fig. A).
  2. To see events happening behind a wall or a barrier.
  3. To monitor the dangerous chemical reactions in laboratory.

Optical fibers

WWW 17

Optical fiber

- **Scientific basis :**
  Occurrence of total internal reflection in plane mirrors.
- **Uses :**
  They are used in medicine as they are used in the manufacture of medical endoscopes used by doctors to :
  - Diagnose some diseases.
  - Visualize injuries inside the body.
  - Asist in doing high risk operations using lasers instead of traditional surgeries.